Methodology for Aligning Johnson Space Center Facilities with Mission

January 30th 2004

Agenda

- **The Task**
- **How the Task was Accomplished**
- **Sample Model Results**
- **Conclusion**

The task: develop methodology to align assets with mission

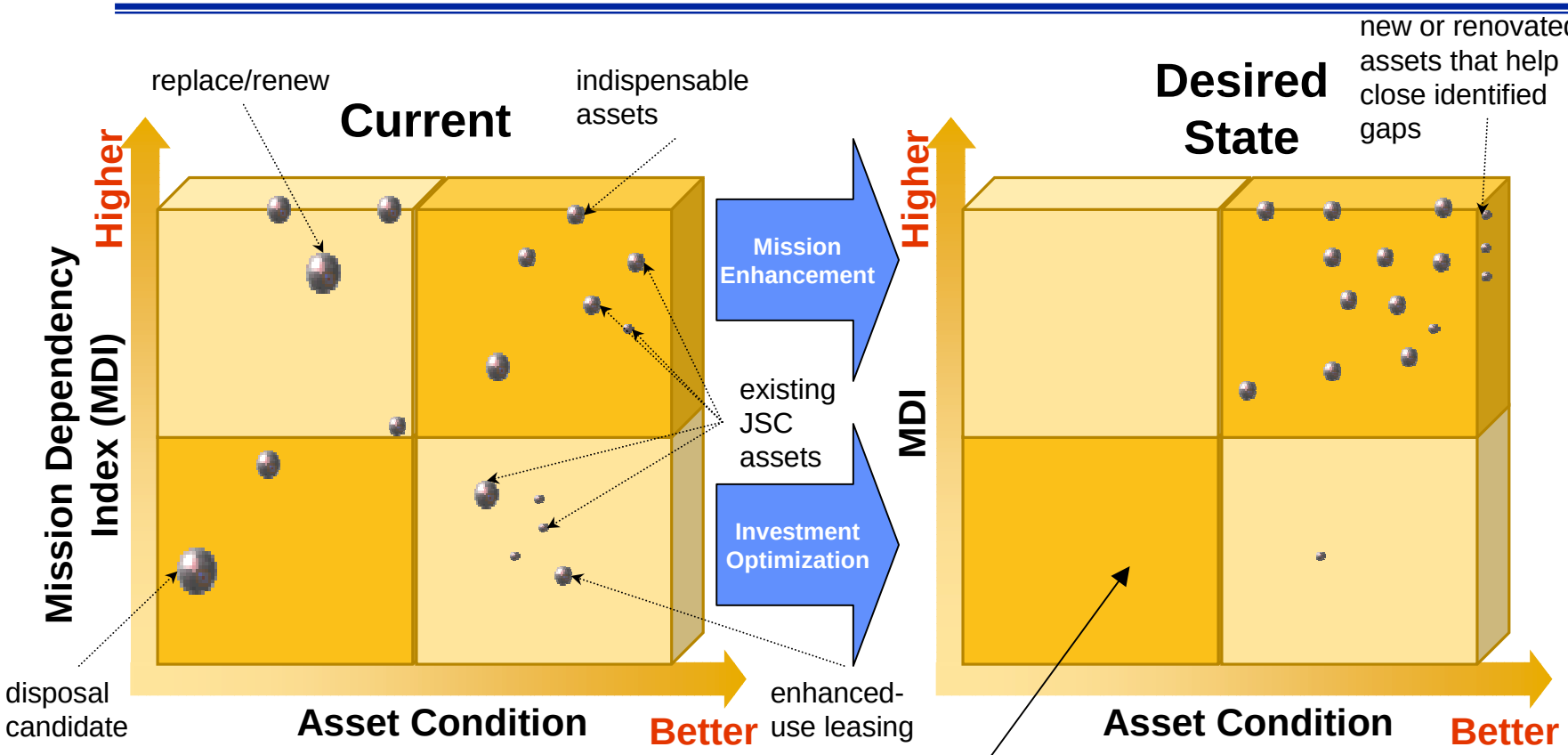
- Develop a methodology to align assets and workforce with Johnson Space Center's (JSC) mission
- Contract was issued by the JSC's System Management Office
  - Ralph Anderson
  - James Ortiz, COTR
  - Period of Performance: April 2003 through December 2003
- JSC stakeholders:
  - Beth Fischer, Center Operations
  - Engineering Directorate
  - Life Sciences Directorates
  - Mission Operations Directorate
  - Space Shuttle Program
  - International Space Station Program
  - Orbital Space Plane (OSP) Program

We will concentrate on the asset/mission alignment methodology

Methodology should address strategic asset management questions

- Do we have the assets we need to accomplish our mission?
  - Gaps in terms of space
  - Gaps in terms of condition
- How much money do we need to invest to eliminate gaps?
- Given limited resources, how should we prioritize project funding?

Ultimate goal: move to asset portfolio that is highly aligned with mission

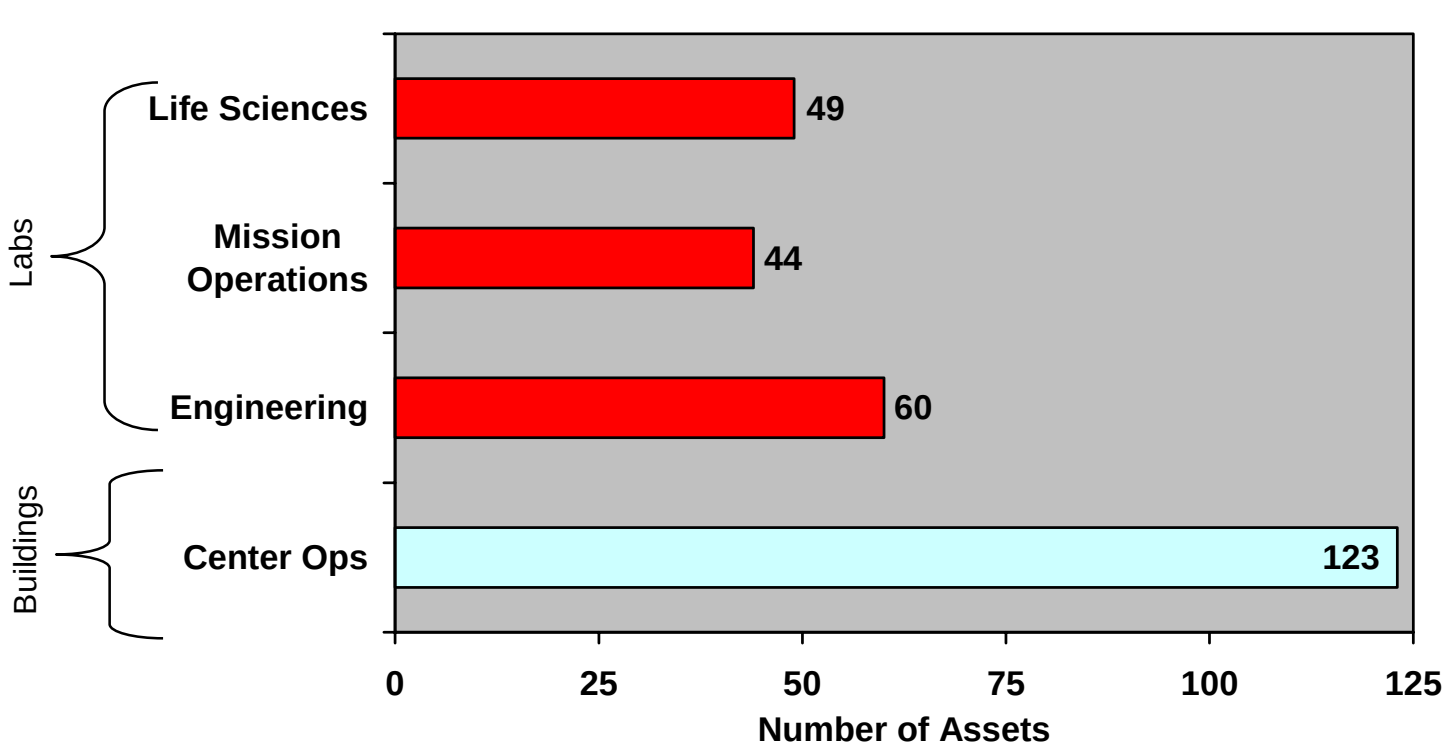


How we executed the assignment

- We leveraged staff with specific skills and knowledge of the NASA mission in various geographies across the country.
  - Primary locations: Houston, D.C.
  - Used resources in other Booz Allen locations near NASA centers
  - Primary skills
    - Facilities/Real Estate Management
    - Investment Analysis of Alternatives
    - NASA subject matter expertise

The study covered mix of JSC's assets

- Analyzed 123 existing assets at the building level
- Also looked at 153 directorate assets valued at greater than $2 million



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How did we implement the methodology?

(1) Determine how JSC assets contribute to implement NASA's strategic vision ("enterprise architecture")

(2) Inventory JSC assets and their condition

(3) Determine maintenance backlog

(4) Establish and weigh parameters that reflect strategy implementation (mission dependency index)

(5) Quantify asset "mission dependency index"

(6) Map existing assets into "mission dependency index"/"condition" matrix

(7) Determine space gaps

(8) Determine how to optimize asset portfolio to meet mission

(1) Determine how JSC assets contribute to implement NASA's strategic vision

- Prepare an "enterprise architecture" for JSC assets
  - Map 123 Center Operations assets to 51 objectives under 10 goals
- How would this compare when assembling an architecture <u>across</u> NASA?

Enterprise Architecture

ILLUSTRATIVE

		Goal 1					Goal 2					Goal 3					Goal 4					Goal 5					Goal 6				
		1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5
Bldg	Description																														
1	Project Management Building																										X	X	X	X	
2	Auditorium and Public Affairs Facility																										X	X	X	X	
3	Central Cafeteria																														
4	Flight Operations Facility																														
5	Jake Garn Simulator and Training Facility																														
7	Crew Systems Laboratory																														
8	Photographic Technology Laboratory																X														

Need to tie each JSC asset to a specific goal

(2) Inventory JSC assets and their condition

- Classify existing asset using various categories: lab, office, shop industrial, etc
- List by asset
- List key data for each asset
- Define asset condition ratings
  - Center Operations used Plexus data
  - Directorates did not have supporting data available

CONCEPTUAL

Asset	Size	Current Condition	Asset Type
Engr Lab 12	5000 sf	3	Lab
MOD Lab 7	75,000 sf	2	Lab
Office Building 1	75,000 sf	4	Office

(3) Determine backlog

- Determine capital investment required to close gap between "current condition" and "target condition" (i.e. backlog)
  - Target condition established by subject matter experts (Center Ops and Directorates)
  - For Backlog
    - ➢ Used Plexus data for "Center Ops buildings"
    - ➢ Gathered range estimates for other assets

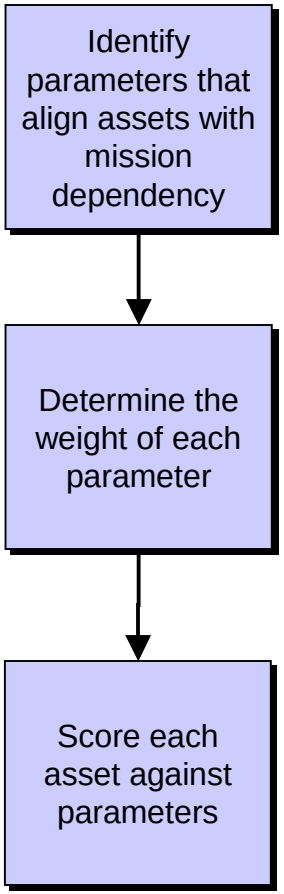
Condition Gap

CONCEPTUAL

Asset	Size	Current Condition	Target Condition	Backlog	Asset Type
Engr Lab 12	5000 sf	3	4	$1,000k	Lab
MOD Lab 7	75,000 sf	2	4	$500k	Lab
Office Building 1	75,000 sf	4	4	$200k	Office

(4) Establish and weigh parameters that reflect strategy implementation

Mission Dependency Index (MDI) Scoring Process

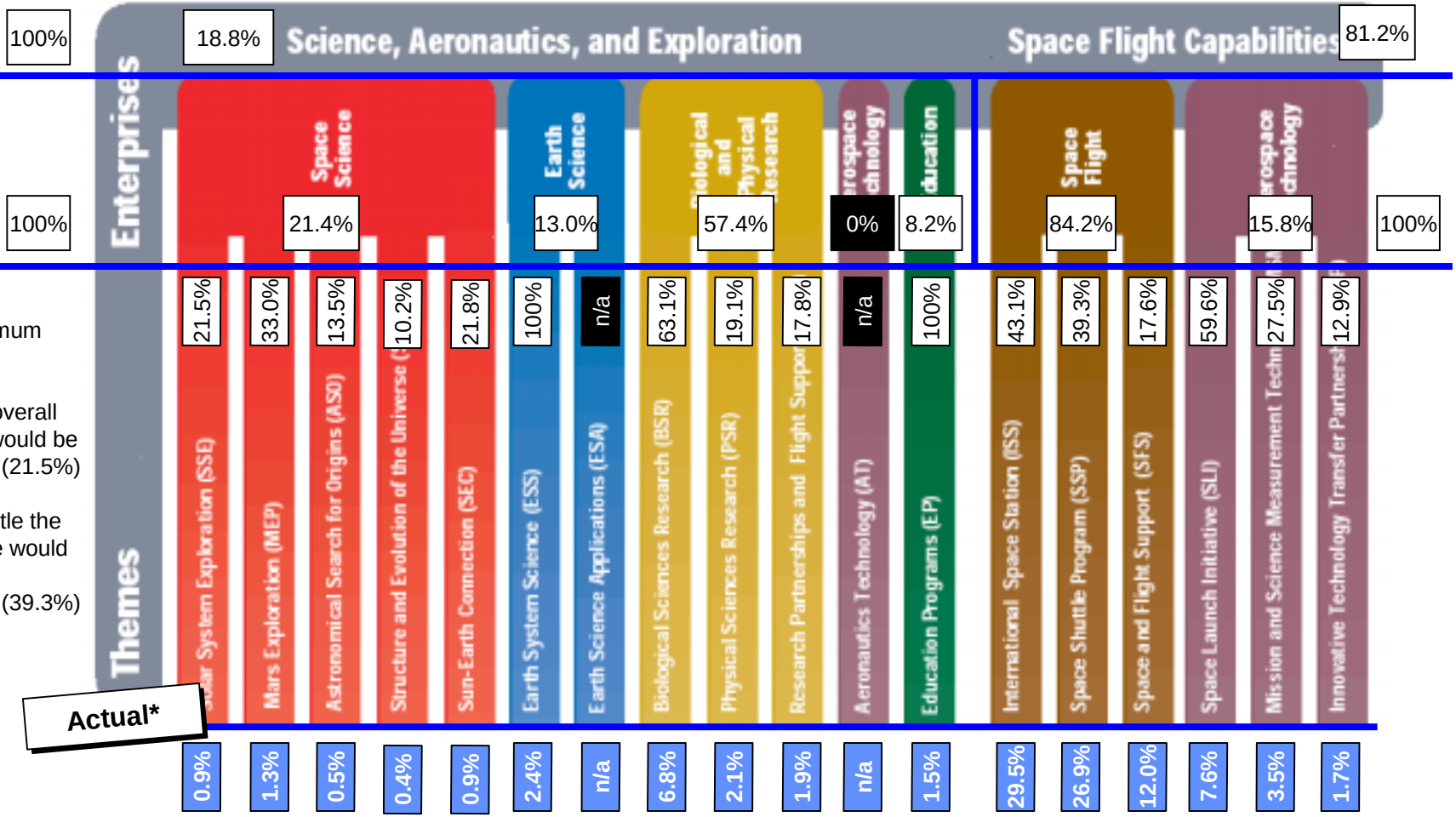


Mutually Exclusive

Proposed Parameters*	Link to 2003 NASA Strategic Plan	Weighting*
Mission	Science, Aeronautics, and Exploration	46.3%
	Space Flight Capabilities	
Availability	Overarching	16.8%
Exclusivity	Overarching	15.3%
Potential Future Need	Overarching	9.1%
Advanced Technology Development	Overarching	12.6%

*Chosen by Johnson Space Center stakeholders in Expert Choice session

(4) Establish and weigh parameters that reflect strategy implementation (cont'd)



Example: Maximum "Solar System Exploration" contribution to overall mission score would be (18.8%)(21.4%)(21.5%) = 0.9%.
For Space Shuttle the maximum score would be (81.2%)(64.2%)(39.3%) = 26.9%

*As voted by Johnson Space Center stakeholders

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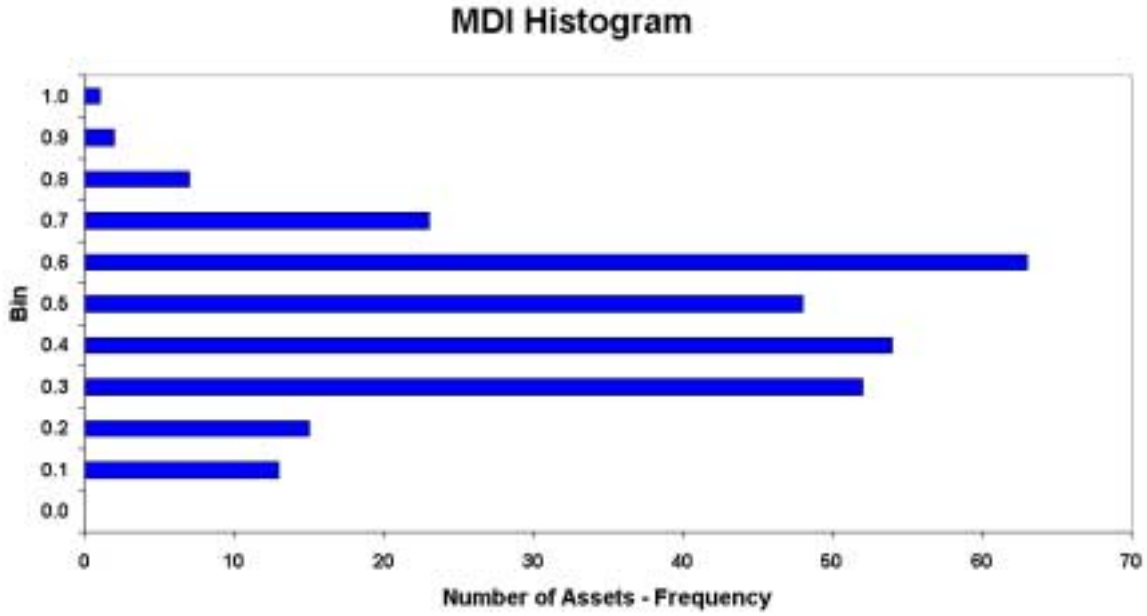
(5) Quantify asset "mission dependency index"

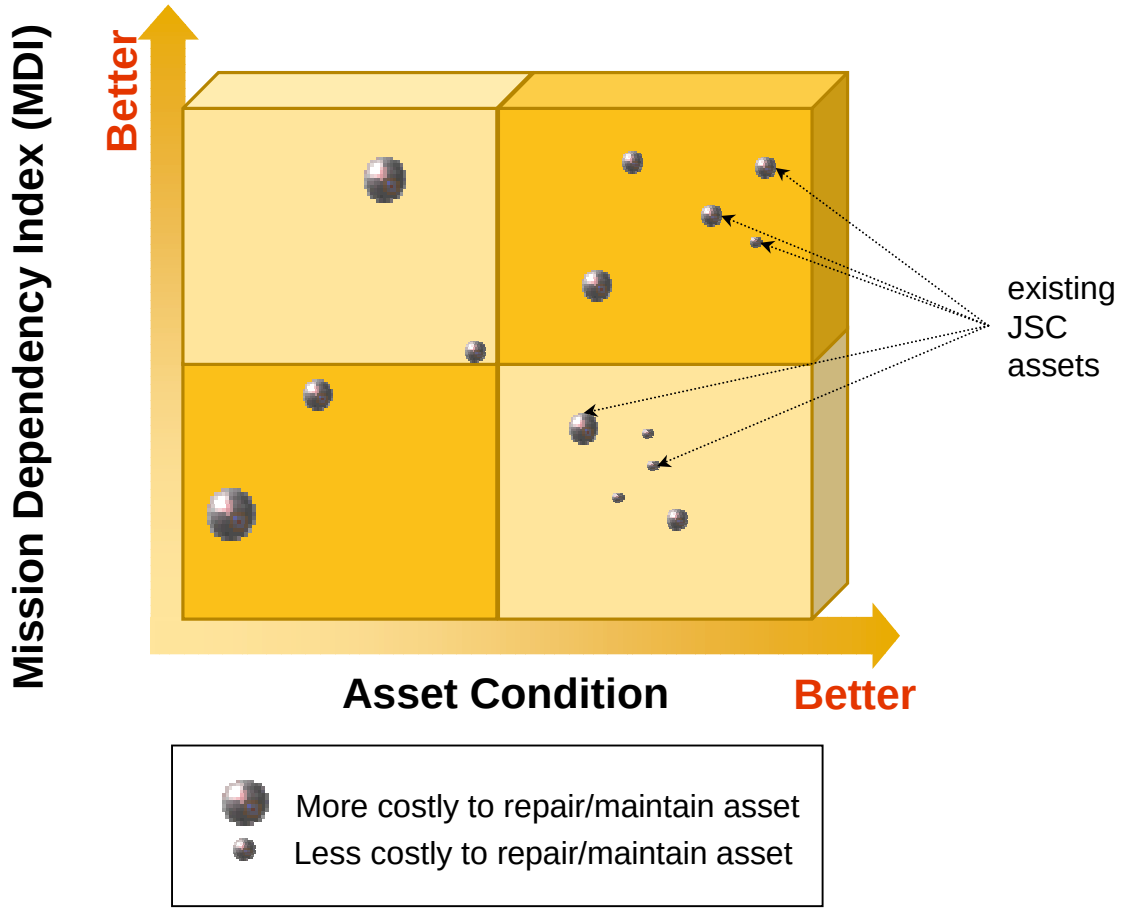
- Scores assets (SMEs) for current mission using Expert Choice
  - New mission would require rescoring
- Most scores fall between 0.7 and 0.3
  - Profile follows expected normal distribution
  - Not every asset was "highest priority"



Source: Johnson Space Center stakeholders

(6) Map existing assets into “mission dependency index” / “condition” matrix

- Helps visualize the asset inventory
- Allows for flexibility
  - Of changing mission need
  - Of “asset-specific” thresholds for condition and investment



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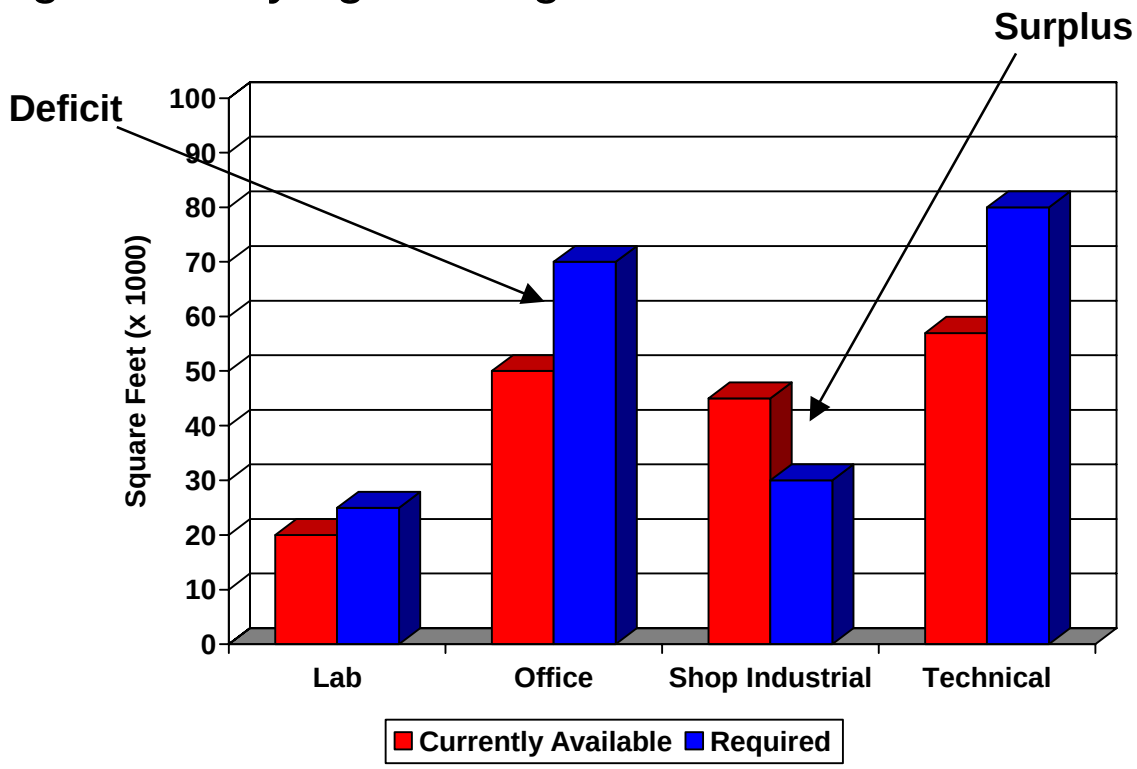
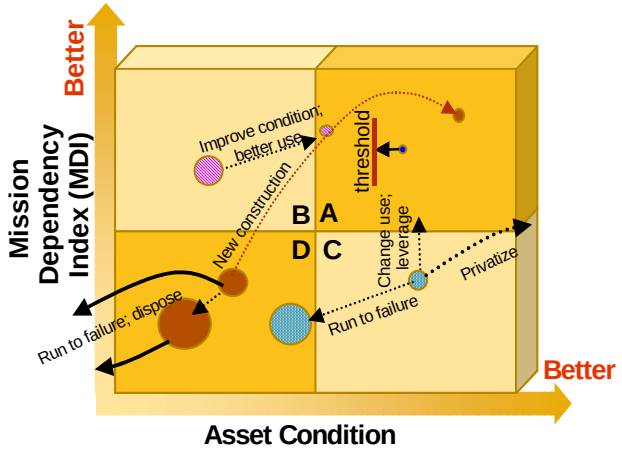
(7) Determine space gaps

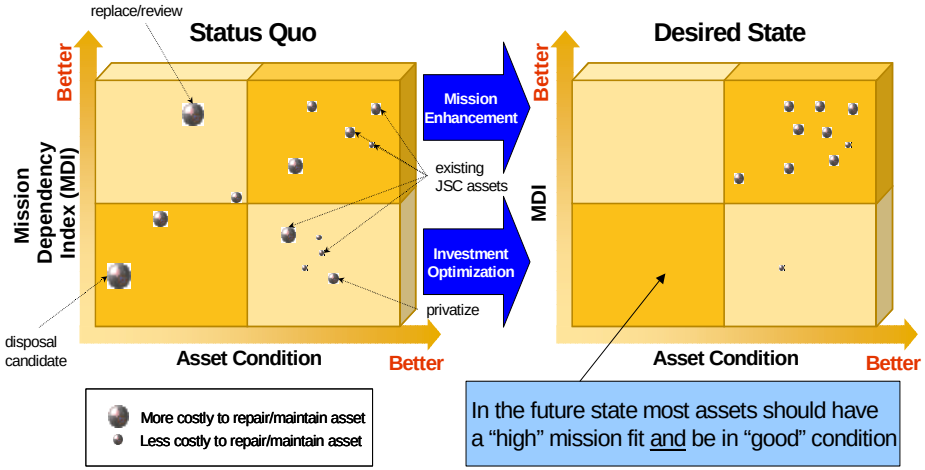
- Based on mission, determine if new assets are required
- New asset requirements could be met by building new assets, leasing or modifying existing structures



(8) Determine how to optimize asset portfolio to meet mission

- Apply strategy to determine which assets to keep, which to divest and how to invest funds in existing assets to improve condition
- Develop prioritization list and funding stream
- Build new assets to meet mission gaps?
  - Lease
  - Refurbish





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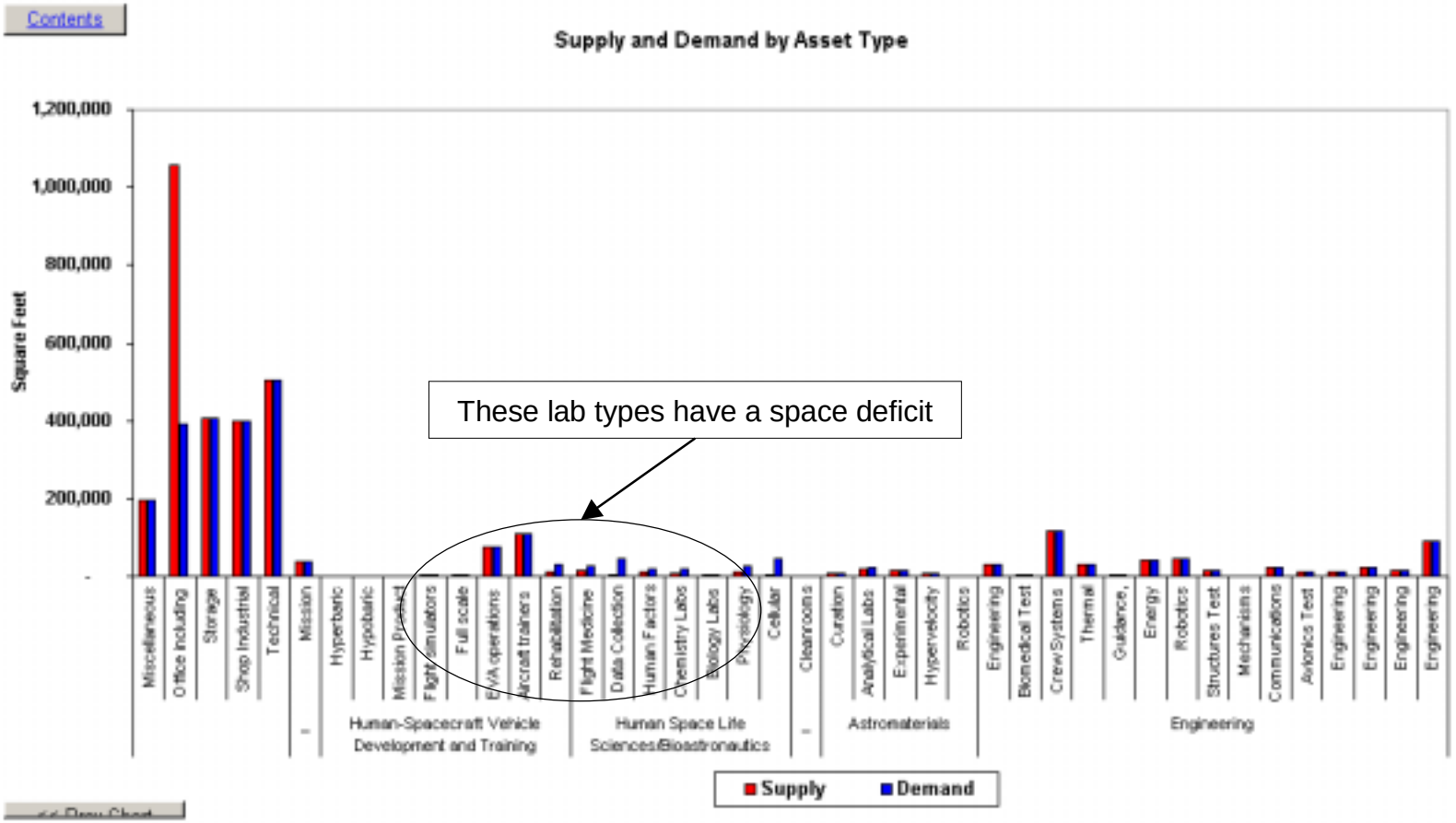
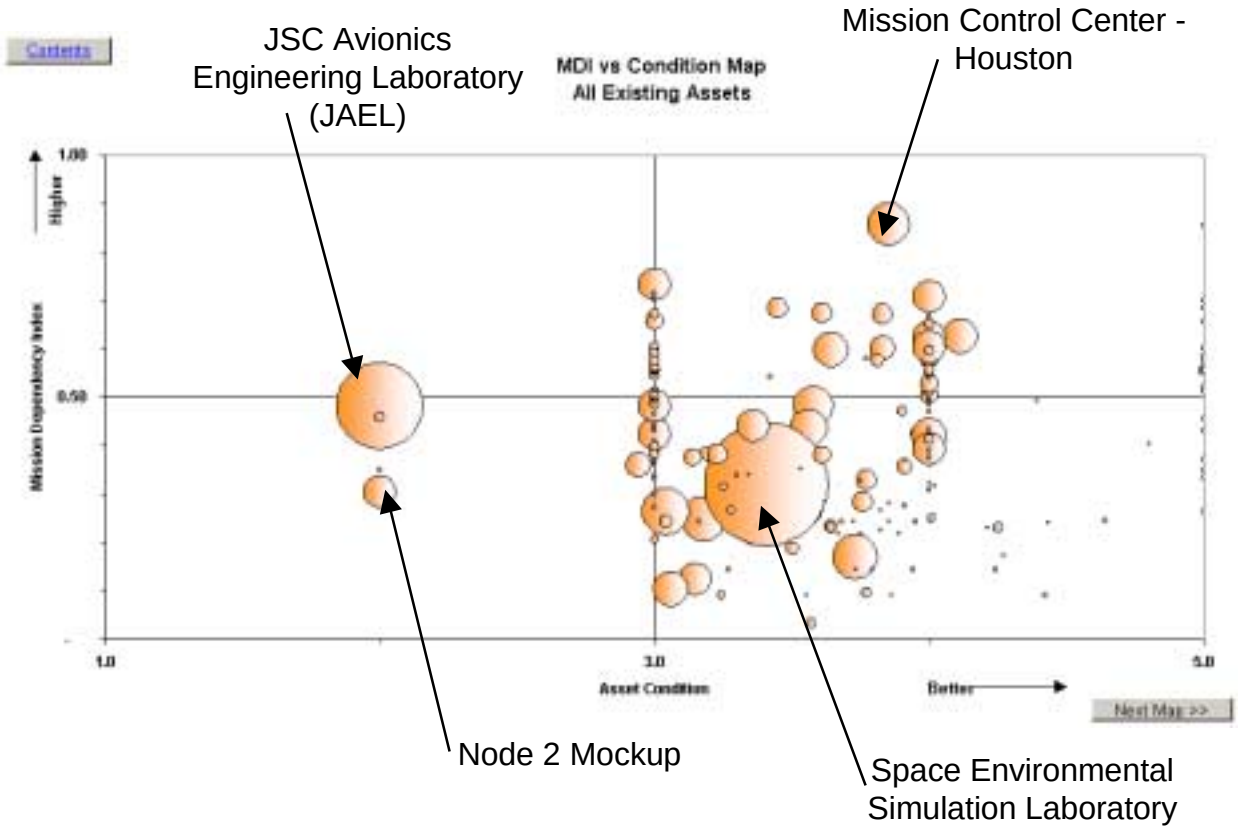
JSC space gap by asset category



Source: Johnson Space Center—Center Operations, Engineering, Life Sciences, Mission Operations Directorates

JSC asset mission/condition matrix

- Y-axis can be rescored for each asset to accommodate mission change
- How can this be accomplished for multiple centers?
- Asset condition
  - Rating (shown)
  - Facility Condition Index



Note: larger bubble diameter indicates larger backlog

Lease vs. build vs. renovate decision

- Based on lifecycle costs, model recommends whether a manager should lease, build new or renovate existing space

Asset Identifier	Bldg #	Room #	Org	Asset Description	Leasing Cost (build to Net sq ft) $ per year	Build + Operate Costs (NPV)	Lease costs (NPV)	Renovate costs (NPV)	Best decision (assuming full funding)	Decision Costs (NPV)
003 EA	007	348, 336AA	Engineering	EVA Mobility Unit Processing & Testing Laboratory	$ 152,000	$ 2,280,000	$ 1,520,000	$ 1,130,000	Renovate	$ 1,130,000
004 EA	007	1032	Engineering	Human Rated Variable Pressure Chamber (10 Ft chamber) and Plant Growth Research Test Complex	$ 60,000	$ 930,000	$ 600,000	$ 480,000	Renovate	$ 480,000
005 EA	007	1300	Engineering	Regenerative Wastewater Processing Systems Development Laboratory	$ 88,000	$ 1,342,000	$ 880,000	$ 342,000	Renovate	$ 342,000
006 EA	007	1023	Engineering	Gas Analysis Laboratory	$ 25,000	$ 387,500	$ 250,000	$ 375,000	Lease	$ 250,000
007 EA	007	2007	Engineering	Advanced Portable Life Support Systems Development Testing Laboratory	$ 40,000	$ 620,000	$ 400,000	$ 420,000	Lease	$ 400,000
008 EA	007	2023	Engineering	Advanced Softgood Materials Testing Laboratory	$ 38,000	$ 589,000	$ 380,000	$ 864,000	Lease	$ 380,000
009 EA	007	3001	Engineering	Soft Goods Fabrication Laboratory	$ 80,000	$ 1,220,000	$ 800,000	$ 320,000	Renovate	$ 320,000

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Conclusion and Summary

- Facility methodology is flexible, but provides a framework to manage assets strategically and dynamically given changing mission requirements
- Methodology brings together all asset stakeholders/stewards (Center Ops + Directorates) to gather “consensus” on asset decisions
- Methodology incorporates, and is driven by, mission need
- Methodology provides a project priority list to address condition and space gaps based on condition and mission dependency
- According to test data, there is a backlog of $150M at JSC that requires analysis/attention
- Methodology is scalable

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